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DEPARTMENT OF COMMERCE AND LABOR

U.S. - COAST AND GEODETIC SURVEY

O. H. TITTMANN

SUPERINTENDENT

ALASKA

SUPPLEMENT

TO

COAST PILOT NOTES ON BERING SEA AND ARCTIC OCEAN

FEBRUARY 1, 1911



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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses.
Distances and velocities of currents are in *nautical miles*.

(2)

PORT MOLLER.

The party on the Coast and Geodetic Survey steamer *Explorer* made a partial examination in 1910 of Port Moller, between Entrance Point and Harbor Point, which supersedes the reconnaissance of this part of the bay made in 1890 as shown on chart 8833. The following information is from the report and examination by the party on the *Explorer*.

Port Moller is surrounded by high mountains, and there is a high ridge across its head. The shore is steep and rocky except at the spits. **Kudobin Islands** are low and afford no definite features on which a bearing can be taken. **Point Doe** and **Point Divide** are bluffs and can be seen from some distance outside of Entrance Point. **Harbor Point** is a low, narrow, grassy sand and shingle spit, which can not be made out distinctly until nearly up with Entrance Point.

Port Moller and Herendeen Bay are indicated from seaward by a valley receding into the mountains. The land at the entrance is low and the chart indicates extensive shoals in the approach, so that access would be somewhat difficult in bad weather even if the charts were based on an accurate survey. The only channel of which we have any knowledge lies on the eastern side of the entrance, and **Entrance Point**, a low grassy spit, is the leading mark for entering. It is marked near the end by sand knolls, some noticeably eroded on the off-shore side. There is deep water close to its southwest end, but a shoal extends some distance off shore from its outer side.

A depth of 14 feet, with deeper water southwestward, was found 3 miles 329° true ($NW \frac{1}{2} W$ mag.) from Entrance Point. This is apparently on the southwest side of the shoal mentioned on page 29 of the Coast Pilot Notes as extending 3 to 4 miles northwestward from Entrance Point. By keeping westward of this shoal the least depth found by the *Explorer* on leaving the port is 4 fathoms at a point $1\frac{5}{8}$ miles 310° true ($WNW \frac{1}{8} W$ mag.) from Entrance Point.

A shoal with little water over it and on which the sea generally breaks at low water lies about $\frac{3}{4}$ mile westward true from the end of Harbor Point and extends nearly 2 miles in a 354° true ($NNW \frac{1}{4} W$ mag.) direction. It then turns northward toward Entrance Point for nearly 2 miles and has 10 to 12 feet on it. The knuckle at the eastern end of the shoal lies $1\frac{1}{4}$ miles 185° true (S by $E \frac{1}{4} E$ mag.) from Entrance Point, and is a little westward of a line joining Entrance and Harbor points.

On the eastern side of the above shoal is a channel about $\frac{1}{2}$ mile wide in its northern part, lying 1 mile southward from Entrance Point, and widening to 1 mile, $1\frac{1}{4}$ to 2 miles northward from the end of Harbor Point. The shoaling is abrupt on the western side of the channel; the eastern side is not developed. The bight on the southeast side of Entrance Point is shoal.

A reconnaissance line of soundings shows that the deep channel continues past Harbor Point, lying fairly close to it, and for some distance farther southeastward exists about as shown on the chart. The two shoals southeastward of Harbor Point are about as indicated on the chart, and the bight on the southeast side of Harbor Point is shoal.

Good anchorage is found about $\frac{3}{4}$ mile from the outer side of the spit of Harbor Point, the southern end of the point bearing 177° true (SSE mag.), distant about $1\frac{1}{4}$ miles, in 10 to 15 fathoms. It is well sheltered from the sea in southeast gales, but the wind draws down the bay with great force. The shoals apparently would afford some protection with on-shore winds. Vessels may anchor above Harbor Point, but the shelter is less in southeast gales and is apparently no better with winds from other directions unless from west or northwest. The tidal currents at the anchorage have some strength, and heavy tide rips occur off Harbor Point.

To make the anchorage northward of Harbor Point pass $\frac{1}{4}$ mile southwestward of Entrance Point on a southeasterly course, and then bring the point astern on a 174° true (SSE $\frac{1}{4}$ E mag.) course until $1\frac{1}{4}$ to $1\frac{1}{2}$ miles from it. Then steer 188° true (S by E mag.), heading to pass about $\frac{1}{4}$ mile westward of the end of Harbor Point.

NUSHAGAK BAY AND RIVER

are important on account of the extensive salmon fishing, and a number of large canneries which are operated during the summer. The entrance of the bay is on the north side of Bristol Bay, between longitude $158^\circ 18'$ and $158^\circ 40'$ W. It is 15 miles wide at the entrance between Protection Point and Etolin Point, and extends about 12 miles in a northwesterly (mag.) direction to Ekuk, where it is 7 miles wide. Here it turns to a northerly (mag.) direction for 9 miles to Nushagak, where it is about 3 miles wide. The surveys extend from the entrance to the mouth of Wood River, the results of which are shown on chart 9050, scale about 1:100,000.

Nushagak Bay and River so far as surveyed are obstructed by extensive shoals near the shores, and by long bars, partly bare at low water, which generally extend in the direction of the channels. In the absence of aids, navigation is safe only in the daytime, when the marks, some of which are distant peaks, can be seen. The worst dangers in the approach are the extensive shoals southward and southeastward of Cape Constantine, the outer one being nearly out of sight of land.

The peninsula of **Cape Constantine** is low, rolling tundra country, with bluffs in places, the greatest elevation being shown on the chart. **Nichols Hills**, 125 feet high, are small sand knolls, the highest part of a ridge that follows the eastern side of the cape, and lie 5 miles northward of Protection Point. At the southwest end of the cape (lat. $58^\circ 26'$ N.) and on the southeast side of the cape (lat. $58^\circ 25'$ N.) are the entrances of two lagoons that can be entered by boats at high water when there is no surf.

Shoals with little water on them in places extend 6 miles southward from Cape Constantine, and the outer shoal (Ustiugof) lies 8 to 9 miles southeastward from the cape. These shoals are in the form of long ridges trending in the direction of the set of the tidal currents around the cape to and from Nushagak Bay. They are steep-to, especially on the off-shore side, and the lead will not give sufficient warning to avoid them. **Ustiugof Shoal** is a narrow ridge with a least depth of 13 feet, and has a length of 8 miles in a 52° true (NNE $\frac{3}{4}$ E mag.) direction with depths less than 4 fathoms. Its southern end lies in lat. $58^\circ 14.5'$ N.; long. $158^\circ 46'$ W. There are depths of 11 fathoms or more close to its southeast side. From a vessel near the shoal Cape Constantine can be seen in clear weather, but the greatest care is required when southward or southeastward of the cape and in sight of it. The shoaler ridges are generally indicated by rips, or breakers at low water, but there is generally nothing to indicate Ustiugof Shoal.

Protection Point, the eastern end of Cape Constantine, is a low marshy spit which extends $1\frac{1}{2}$ miles from the higher land. There is the entrance of a lagoon on the north side of the point 2 miles westward of its end, which is closed at low water, but at other times boats can enter, although the current is strong on the ebb. A narrow shoal awash in places at low water extends $4\frac{1}{4}$ miles southward from the point, its southern half lying about 1 mile from shore; there is a narrow channel for boats between the point and the north end of the shoal. A detached shoal with 15 feet on it lies 2 miles eastward from the point.

The low spit eastward of Nichols Hills forms a cove, dry at low water, that can be entered by boats at high water and affords shelter except with northerly winds.

Igushik River has two salteries on the west side near the entrance, and vessels up to about 24 feet draft have been taken out. The channel into the river is not surveyed. The flat on the eastern side of the channel leading to the mouth of the river shows for nearly its full length at low water. The bar at the entrance of the channel has a depth of 12 to 14 feet on it, and lies about $7\frac{1}{2}$ miles southeastward of the mouth of the river and $8\frac{3}{4}$ miles northward from Protection Point.

Igushik Ridge, on the west side of Igushik River, is prominent, having a greatest elevation of about 260 feet near its northern end, where it breaks sharply to the river. The

peninsula eastward of the river is low, and on its eastern side is a slatted beacon, upper half black, lower half white. The range of the beacon and the summit at the north end of Igushik Ridge marks the turning point for the cross-over southwestward of Ekuk.

Snake River is not used except by fishing boats. The channel leading to the mouth of the river has a depth of about 8 feet, and is well defined at low water by the flats, which uncover, except at the entrance, the latter lying about 3 miles northeastward of the beacon described in the previous paragraph.

The land on the eastern side of the bay is low, rolling tundra, and the entrance point is rounding without a distinct point. **Etolin Point** is here applied to the middle and highest one (elevation 90 feet) of three prominent bluffs, 1 to $1\frac{1}{2}$ miles apart. A rounded hill about 150 feet high lies $1\frac{1}{2}$ miles northeastward of Etolin Point, and is one of the first summits to show when approaching. A higher ridge lies $1\frac{1}{2}$ miles farther inland, but neither are prominent.

The 3-fathom curve lies $6\frac{1}{2}$ miles, and the 5-fathom curve 8 miles, from the shore southeastward of Etolin Point. The shoaling is gradual, and the lead is a good guide in approaching the eastern shore when outside of a line joining Etolin and Protection points. Above this line there are long shoals, most of which show in places at low water, in the eastern half of the bay.

Ekuk Bluff is 170 feet high and is prominent from Nushagak Bay. A spit extends $1\frac{1}{4}$ miles northward from the bluff. **Ekuk** is a native village on the spit at the foot of the bluff, and there is a cannery on the north end of the spit. The lagoon inside the spit is bare at low water.

Clark Point is low and is marked by two canneries and a high water tank. A ridge, 150 feet high with a bluff at the water, lies $\frac{5}{8}$ mile southward from the point and is the prominent feature from the bay.

Clark Slough, $1\frac{1}{2}$ miles northeastward of Clark Point, is navigable for launches about 17 miles at high water. The bar at its entrance has a depth of about 3 feet at low water. There is a cannery on the northern side at its entrance.

Nushagak post office is on **Nushagak Point**, $6\frac{1}{2}$ miles northward from Clark Point. There are two canneries, a school, and Russian church. The point is a prominent ridge 250 feet high, eastward of which is a deep valley. On the eastern shore 2 and 5 miles northward of Nushagak are a disused cannery and a native village.

The western shore from **Coffee Point** to **Snag Point** is generally a line of bluffs. **Dillingham** post office, a native village, and a cannery are on **Bradford Point** abreast **Williams Island**, the latter grassy and awash at highest tides. The Government courthouse is at Dillingham. There are two canneries and a high tank west of Snag Point.

Wood River has its entrance northward of Snag Point, and has a length of about 24 miles to **Aleknagik Lake**. Its width varies from about 600 yards in its lower part to about 50 yards where it joins the lake. A depth of 3 to $3\frac{1}{2}$ feet at low water can be carried 15 miles up the river and not more than $2\frac{1}{2}$ feet to the lake, though at high water 4 feet can be carried this distance. The lake is about 24 miles long.

Prominent features.—Northward of the bay is a chain of prominent mountains, some of which are described in the sailing directions. They are snow covered in early summer, but bare except in the ravines by the middle of July. In clear weather the peaks show from a long distance seaward, but much of the time they are obscured by clouds and haze. Many of the summits are shown on the chart.

Channels.—The channel generally used is near the middle of the bay, and leads in a depth of about 16 feet over the "outer bar," lying 7 miles 203° true ($S \frac{1}{8} W$ mag.) from Ekuk Bluff. Southwestward of Ekuk the channel crosses the bay over several bars where there are depths of 12 to 14 feet. It then follows the eastern shore to the anchorage off Clark Point. The deepest draft of the cannery vessels entering the bay is about 24 feet.

The channel on the eastern side above Clark Point shoals gradually to 8 feet at Nushagak.

The channel to the canneries on the western side crosses the river at Clark Point, where the depth is about 12 feet, and follows the western shore above Coffee Point at a distance of about $\frac{1}{4}$ mile.

Anchorage.—There is no anchorage in the outer bay sheltered from all winds. In southwest weather the western side of the bay should be selected, and in northeast weather the eastern side. With winds from east to south (mag.) there is no shelter, and a heavy sea makes into the bay. The strong current causes a vessel at anchor to lie stern or broadside to the sea when the wind opposes the current. The bars seem to afford little protection. In northerly weather any part of the bay is sheltered, but the wind does not appear to blow with force from that direction during the summer.

There is good anchorage, sheltered from southwest winds, for vessels of 12 feet or less draft 1 mile 21° true (*N* mag.) from Protection Point in about 3½ fathoms. Deeper draft vessels should anchor farther northeastward.

Above Ekuk Spit good anchorage will be found wherever the depth will permit. The cannery vessels are anchored or moored off their respective plants, except those at Nushagak, which are anchored in the channel between it and Clark Point. This part of the bay is very choppy in heavy weather, but the sea seldom, if ever, is heavy enough to endanger a vessel. The bottom is sand, but the anchor holds well if given sufficient scope, say 60 fathoms. The currents are strong, and care should be taken to avoid dragging. Vessels remaining long are anchored in line in the channel to interfere as little as possible with the nets.

Supplies.—The nearest point at which coal can be purchased is Unalaska. Some provisions can be obtained at the companies' stores. Fresh meat is not generally obtainable, and game is scarce. Plenty of fish can be had during the season. Fresh water can be boated off from the cannery wharves. The cannery launches and tugs go to the wharves at high water. That part of the cannery wharves extending beyond high water is removed during the winter. The water is fresh at some of the river mouths on the last of the ebb, but it is too muddy for boilers or drinking. Northward of Dillingham there is a sparse growth of timber, which becomes heavy farther inland. Southward of Dillingham there are only occasional clumps of alder bushes.

Repairs.—The large tides and flats make it easy to beach a vessel of moderate draft (say 18 feet). A good place is at Clark Point just above the cannery. Small machine repairs can generally be done at the companies' shops.

Communication.—The mail schedule is monthly, by steamer during the summer from Seward by way of Unalaska, and in winter from Katmai by dog team. Some of the canneries have communication by telephone. There is little travel in summer except by boat on account of the soft tundra country and numerous lakes. There are some small native villages above Ekuk, and a few white men remain during the winter.

Weather.—The weather is variable, but it is considered better than farther westward. Spells of bad weather occur, and their duration increases in the late summer. In August and September, 1909, there was much stormy weather. Southwesterly winds predominated in the early summer, and easterly winds later.

Easterly winds bring thick weather and rain, and are accompanied by low or falling barometer. Southwesterly winds, if moderate, bring fair weather, but if strong, bring rain. Northwesterly winds bring fine, clear weather, but seldom blow steadily. In settled weather the wind may be light from any direction, accompanied by showers. After a gale there is usually no shifting of the wind or sudden breaking of the storm, but the wind decreases, and there is a gradual return to fair weather.

Fog sometimes sets in from sea, but there is little fog during the summer.

Ice.—Nushagak Bay is usually open to navigation the latter part of May, but the movement of the ice is variable, depending on the direction of the wind. Northeast winds drive it out of the bay. It is stated that the arrival of the cannery vessels has been as late as June 17. The cannery vessels leave Bristol Bay the latter part of August, the pack having been completed. It is not known when ice begins to form, but it is probably late in the fall.

Tides are influenced to some extent by strong winds. The currents have considerable strength, the ebb being the stronger, on account of the discharge from the rivers. The maximum ebb current observed is 3.8 miles, and flood, 2.9 miles. The ebb usually begins shortly before high water and continues to run after low water, roughly about 6½ hours ebb and 6 hours flood.

NUSHAGAK BAY.

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The period of slack water is usually short. The currents generally set fair with the channels, but in navigating the bay the course is often across the current, and allowance must be made for it.

TIDES: BRISTOL BAY.

Standard port for reference is Sitka.

Station.	Time differences.		Ratio of ranges.	Rise of H. W. above plane of reference.	Mean rise and fall.
	H. W.	L. W.			
	<i>h.</i> <i>m.</i>	<i>h.</i> <i>m.</i>		<i>Feet.</i> <i>Feet.</i>	<i>Feet.</i>
Port Moller.....	-4 32	+ 8 07	0.97	6.5 to 12.0	7.5
Protection Point.....	+0 10	-12 01	1.62	11.0 to 19.0	12.5
Clark Point.....	+0 29	-11 35	1.97	13.5 to 22.0	15.2
Dillingham.....	+0 54	-11 02	2.21	15.5 to 24.0	17.0

The time differences applied to the Sitka tide give the Bristol Bay tides in 165th meridian time.

CURRENTS IN NUSHAGAK BAY.

Locality.	Differences referred to Kodiak.				Strength of Current.			
	Slack before flood.	Strength of flood.	Slack before ebb.	Strength of ebb.	Flood.		Ebb.	
	Referred to L. W.		Referred to H. W.		Direction.	Velocity.	Direction.	Velocity.
	<i>h.</i> <i>m.</i>	<i>h.</i> <i>m.</i>	<i>h.</i> <i>m.</i>	<i>h.</i> <i>m.</i>	<i>True.</i>	<i>Miles.</i>	<i>True.</i>	<i>Miles.</i>
Protection Point.....	-0 16	+2 44	-0 34	+2 38	N 10° W	2.4	S 10° E	2.4
Etolin Point.....	+0 14	+3 14	-0 04	+3 08	N 5° W	2.6	S 5° E	2.6
Clark Point.....	+1 05	+4 02	+0 40	+3 56	N 30° E	3.1	S 30° W	3.2
Coffee Point.....	+1 14	+4 08	+0 44	+4 02	N 20° E	3.2	S 20° W	3.2
Dillingham.....	+1 34	+4 26	+0 59	+4 19	N 2° E	3.2	S 2° W	3.2

The above differences applied to the time of tide at Kodiak will give 165th meridian time of current in Nushagak Bay. A plus sign indicates that the current is later, and a minus sign that it is earlier than the time of tide.

SAILING DIRECTION, NUSHAGAK BAY.

The channels and bars are probably subject to constant change due to the action of currents, and to a smaller extent by the action of the sea. Changes of considerable extent are reported by those of long experience. A margin of safety should therefore be allowed for the soundings found by the survey. It is also well to remember that with a very low tide the water may fall as much as 2 feet below the plane of reference of the chart.

The navigation of the bay is not easy, and a stranger should proceed with great caution. Tide rips may be taken as good evidence of shoals. The shoals are long ridges trending in the direction of the set of the tidal currents, and a course should not be laid across the currents unless sure of the position, as the danger of stranding is greatly increased. A stranger, unless sure of his position, should navigate only on a rising tide.

It is recommended for vessels bound to Nushagak Bay to make Cape Greig, which is high and easily recognized, and then shape the course for the entrance, favoring the Etolin Point side in preference to the Cape Constantine side. The currents that may be experienced when crossing from Cape Greig are not known, but there may be considerable set. Great care should therefore be exercised in approaching the entrance, and the lead should be used constantly. The land at the entrance when first seen in approaching is indefinite, and presents no feature that can be readily identified.

The usual route up Nushagak Bay is to pass 5 or 6 miles off Protection Point and shape the course for a position with the highest part of Ekuk Bluff bearing 58° true ($NE \frac{3}{4} N$ mag.) distant $4\frac{1}{2}$ miles. If the mountains northward are showing, the range of peak X in line with the point where the slopes of peaks T and S meet will lead to that position; the course on the range is 342° true ($NW \frac{1}{2} N$ mag.), passing $5\frac{3}{4}$ miles off Protection Point, and the distance above Protection Point is $14\frac{1}{2}$ miles. There is a break of considerable breadth to the right

of the range peaks, between them and the prominent notched peak marked E on the chart. Peak X is the left one of a pair of sharp peaks, the right one being hidden behind S when on the range.

Follow the range $14\frac{1}{2}$ miles above Protection Point until the prominent red water tank standing above the canneries just clear of the bluff at Clark Point shows in the middle of a deep depression in the ridge, $1\frac{3}{4}$ miles eastward of Nushagak Point. At this point the beacon on the shore eastward of Igushik River will be in line with the summit at the north end of Igushik Ridge, bearing 278° true ($WSW \frac{1}{8} W$ mag.). The left end of the mountains northwestward will also be approximately in line with the north foot of Igushik Ridge.

Steer for the water tank at Clark Point on the range described in the preceding paragraph, course 32° true (N by E mag.) for 1 mile, crossing a bar with 12 to 14 feet over it, until the highest part of Ekuk Bluff bears 66° true (NE mag.). Then head for the bluff, taking care to keep the bearing on and not to be set off by the current, which leads across two bars in a depth of over 14 feet. Continue this course for $2\frac{1}{2}$ miles until about 1 mile from the bluff. Then steer 344° true ($NW \frac{5}{8} N$ mag.) for about 2 miles and pass $\frac{1}{2}$ to $\frac{3}{4}$ mile off the spit northward of Ekuk Bluff. When the cannery at the north end of the spit bears 103° true ($E \frac{3}{4} N$ mag.), distant about 1 mile, steer 21° true (N mag.) for Nushagak Point and anchor $\frac{1}{2}$ mile or a little less off the cannery at Clark Point, in 5 to 6 fathoms (low water).

Vessels can pass eastward of the outer bar by standing on the range of peak Z in line with the notch in peak E, bearing 346° true ($NW \frac{1}{8} N$ mag.), until the left summit of a saddle peak (the last toward the left of the distant high mountains) is in range with the north foot of Igushik Ridge, bearing 287° true ($W \frac{3}{8} S$ mag.), being careful not to overrun. Stand on the latter range $1\frac{1}{2}$ miles until on the range of peaks X, T, and S of a preceding paragraph. The 346° true ($NW \frac{1}{8} N$ mag.) course leads about $\frac{1}{2}$ mile westward of a bar which shows about 6 feet at low water, the course being changed when abreast its northern end. By this route vessels can proceed to an anchorage below the upper bars at low water, from which it is not difficult to get in when there is sufficient depth on the bars.

Clark Point to the upper canneries.—From Clark Point the channel crosses the bay, where the least depth is about 12 feet, and then follows the western shore above Coffee Point at a distance of about $\frac{1}{4}$ mile. Above Coffee Point the channel is narrow in places, with steep slopes and very shoal water on both sides. It should be navigated with great caution by a stranger, and on a rising tide.

From a position $\frac{1}{2}$ to $\frac{3}{4}$ mile off Clark Point steer 319° true (NW by $W \frac{1}{2} W$ mag.), with the water tank in range with a small knoll (apparently a clump of alders) on the ridge astern. Hold the range for $\frac{3}{4}$ mile after peak C is in range with the highest part of a low bluff 3 miles above Coffee Point, bearing 2° true (N by $W \frac{3}{4} W$ mag.). Then steer 20° true ($N \frac{1}{8} W$ mag.) for Bradford Point for $1\frac{1}{4}$ miles until Coffee Point bears 325° true (NW by W mag.), distant $\frac{3}{4}$ to 1 mile. Then steer 353° true ($NNW \frac{1}{2} W$ mag.) for $1\frac{1}{8}$ miles to a position 500 to 600 yards from shore at the first break in the bluff $\frac{1}{2}$ mile above Coffee Point.

For the next 3 miles the channel is about 300 yards wide. The midchannel is generally $\frac{1}{4}$ mile from shore—a little more at the head of the bight $1\frac{1}{2}$ miles northward of Coffee Point, and a little less at points $\frac{5}{8}$ mile southward and the same distance northward of this bight. The channel is then about 1 mile wide to Bradford Point, and the western shore is clear if given a berth of $\frac{1}{4}$ mile.

Follow the western shore at Bradford Point at a distance of $\frac{1}{4}$ mile until about $\frac{1}{2}$ mile above the courthouse, and then keep $\frac{3}{8}$ mile from shore. Anchorage in 4 to 5 fathoms (low water) may be had about $\frac{1}{4}$ mile from the shore at the canneries southwestward of Snag Point. The shoal eastward of the channel above Bradford Point is eastward of a line from the courthouse to the high tank at the cannery above, bearing 41° true (N by $E \frac{3}{4} E$ mag.).

Peak C is a sharp peak at the western end of a low detached mountain ridge, and is the first mountain to the left of peak B, which is the most conspicuous toward the head of the bay. In making the turn 2 miles southward of Coffee Point it should be noted that the prolongation southward of the shore from Coffee Point to the bight $1\frac{1}{2}$ miles above, intersects the range over the water tank on Clark Point at a point near the flat bare at low water that makes out from the western shore.

KUSKOKWIM BAY AND RIVER.

The following notes are from a report by the party on the Coast and Geodetic Survey steamer *Explorer*, which visited the region from Cape Newenham to Kwinak in 1910.

This region is dreaded by navigators on account of the many shoals, banks, and bars, extensive shoals bordering low shores, difficulty of communicating with the shore and securing a pilot, lack of aids and accurate charts, and the thick and rough weather. A few ocean steamers, deepest draft 14 feet, have been taken up to Bethel.

The chart of this locality is a compilation from various sources, and in the absence of surveys is very inaccurate, especially above Goodnews Bay. No surveys have been made, but the observations by the party on the *Explorer* indicate that the entrance of Goodnews Bay should be 2 miles and Baluka Hill 7 miles nearer Cape Newenham than as shown on chart 9302. The beacon on the north end of Long Island (Carter Spit) is in approximately lat. $59^{\circ} 18' N.$ or 18 miles southward of the charted position, and about 36 miles northward of Cape Newenham. Kwinak is in approximately lat. $59^{\circ} 45' N.$, long. $161^{\circ} 54' W.$, or 12 miles southeastward true from its charted position.

The landfall is **Cape Newenham**, which can be approached as close as 1 mile in depths of 20 fathoms. Southward of the cape the tidal current sets east or west, and northward of the cape it sets north or south. Heavy tide rips occur near the cape and extend some distance northwestward. Anchorage can be had on both the north and south sides of the peninsula, but neither side is sheltered in west or southwest gales. The only directions that can be given are to approach the shore with caution, using the lead.

Northeastward of Cape Newenham there are mountain peaks with low narrow valleys between. Between the cape and Goodnews Bay high land is found close to shore except at the inlets. Northward of Goodnews Bay the coast is a broad belt of low tundra, back of which the mountains rise abruptly. The range trends nearly north true to near lat. $59^{\circ} 35' N.$, where it recedes eastward. The land near the mouth of the Kuskokwim River is low tundra and can not be seen to any distance. The land on the west side of the river was not sighted.

The usual route for vessels bound to the Kuskokwim is to make Cape Newenham, stand northward from the cape, passing eastward of the outer shoal marked "Breakers" on the chart, and make the beacon on Carter Spit at a distance of about 4 miles from shore. They then bring the beacon in range with a certain peak, bearing about *E* mag., and stand westward on this range, which leads over some shoal bars and into the main channel where 8 to 11 fathoms are found. They then follow this channel into the river. The channel below Eek River is westward of midstream, but no directions can be given. Above Eek River the channel is said to be tortuous and more difficult to follow than that below.

The peak used for the back range in crossing to the main channel is probably the mountain described with Carter Spit, bearing 110° true (*E* $\frac{1}{2}$ *S* mag.) from the beacon. The least water on the bars is said to be 9 feet at low water, so that it is necessary for vessels to cross at high water. There are also some bars between Carter Spit and the position 4 miles off the beacon, on which there is reported to be a depth of 15 feet.

The *Explorer* steered 356° true (**NNW** mag.) with the end of Cape Newenham astern for 34 miles. For 17 miles above the cape the depth was over 12 fathoms. It then suddenly decreased to $5\frac{1}{2}$, and along the remaining half of the course it varied from that depth to 13 fathoms. Above this point difficulty was experienced in keeping in the channel, and the depth was irregular. The bottom appears to be cut by the current into narrow channels and bars. It is necessary to keep the lead going constantly, and great care is required to avoid dangerous shoals. The least depth found was 12 feet with Baluka Hill bearing about 109° true (*E* mag.), but at several other places less than 4 fathoms was found.

The long 2 and $2\frac{1}{2}$ fathom shoal, marked "Breakers," shown on the chart about 10 miles off shore, is said to exist in about that locality. There is reason to believe that it extends much farther southward than shown. There are two reports of depths of $1\frac{1}{2}$ and 2 fathoms lying 14 miles 311° true (**WNW** mag.) from Cape Newenham. The position is doubtful, and vessels should pass near the cape on a northerly or southerly course.

Pilot.—The native pilot, who is the only regular one, lives at Eek River during the summer. He has a launch and is sometimes on the lookout at Carter when a vessel is expected. His knowledge of the channels seems to be fair, but it is judged that only a limited dependence should be placed upon him as pilot of a vessel.

Current.—The flood current sets northward and ebb southward, and the current appears to turn near the time of high and low water. The greatest velocity of current logged by the *Explorer* was 1.9 miles. An ebb current of 6 miles is reported to have been observed on one occasion off Carter, but such a velocity is believed to be rare if it ever occurs.

Weather.—The Kuskokwim is reported to have similar weather conditions to other parts of Bering Sea. Strong winds, rain, or fog often prevail.

Ice.—The river is reported to be usually open to navigation about June 1. At Bethel it opens a little earlier, the latter part of May. The spring of 1910 was unusually late, and the river at Kwinak was not clear of ice until June 7.

The soundings on the chart give some idea of the course to be followed from Cape Newenham to Goodnews Bay. Apparently the best route is to follow a curve which lies about midway between a direct line and the general curve of the shore. Rounding Cape Newenham at a distance of about 1 mile, the *Explorer* steered 40° true (N by E $\frac{1}{8}$ E mag.) with the end of the cape astern, until about 10 miles from it, and then steered more northward to an anchorage 2 miles southward of the entrance, with Baluka Hill bearing 29° true (N $\frac{1}{8}$ E mag.). The depths shoaled gradually from 12 fathoms near the cape to 4 fathoms about 4 miles from the anchorage, the latter depth being carried to the anchorage. Passing $1\frac{1}{2}$ miles off the cape a 44° true (NNE $\frac{1}{4}$ E mag.) course for the prominent mountain on the south side of Goodnews Bay leads over broken ground and shoals, on which about 17 feet was found. By hauling eastward deeper water was found.

Goodnews Bay is apparently shoal except a small area just inside the entrance, where there is sufficient depth and swinging room for a vessel to anchor. Strong eddies and swirls were observed here on the ebb. The best depth found on the bar outside the entrance is 14 feet. A depth of 19 feet at high water was carried over the bar on a 23° true (N $\frac{3}{8}$ E mag.) course for the south point at the entrance, the least depth being found about 1 mile from the entrance. Thence the depths increased on the course until in a deep channel that leads close to the outer side of the southern spit and close to the inner side of the northern spit at the entrance. The entrance points are low spits, and there is a good boat landing on a steep hard beach on either side of the spits. The shoal outside the entrance appears to exist as shown on the chart.

Mumtrak is a small native village located as shown on the chart. There is a channel close to the village in which there is apparently enough water for boats at all times. There is no timber in this region, but there is driftwood on the outside beach.

Baluka Hill is a prominent conical hill, with steep rocky sides, that rises abruptly from the north side of the bay and stands at the southwestern foot of higher mountains. Its bearing from the entrance of the bay agrees with the chart, but it is probably not more than 3 miles from the entrance.

Long Island (locally **Carter Spit**) is said to be a spit and not an island. It is very low, and is marked at its northern end by a black tripod beacon 40 feet high. To assist in finding the beacon, it bears 110° true (E $\frac{1}{8}$ S mag.) when in range with a conical mountain, having a small sharp summit at the left edge of its flat top, which stands in front of a higher range. On the opposite side of the valley to the left of the mountain is a prominent, low, dark mass of rock at the foot of the mountain range; this rocky hill in line with the beacon bears 98° true (E by N mag.).

Carter is the name applied to two shacks built by prospectors, and there are occasionally a few natives. A pilot may be on the lookout here during the summer when a vessel is expected. The cove inside Carter Spit is largely shoal, but there is shelter for small craft except from northerly and northwesterly winds. It is reported that the soundings shown on the chart are about right, but vessels should not attempt to enter until after a careful examination. Launches water from the streams but it is inconvenient on account of the flats.

Jacksmith Bay is the local name for the indentation north of Carter. It is said to be shoal. It is far southward of its charted position, and there is good reason to believe that its extent is much less than shown.

Kwinak (Quinhagak P. O.) is almost inaccessible by water because of great flats bordering the shore, so that row boats can approach it only at high water. Small craft can scarcely get within sight of the village and remain afloat at low water. Supplies are landed with great difficulty and risk, owing to the flats and exposure. There are a mission and a few whites at the village. The mission is painted white and is a good mark.

Eek River enters the Kuskokwim from eastward abreast the island shown on the chart in lat. 60° 17' N. There is a native village here, and the native pilot and a trader of the Kuskokwim Commercial Company during the summer. The main channel is close to the western bank of the Kuskokwim opposite Eek River, and it is said that there is good anchorage here and that supplies can easily be landed on the west side. The landing at the village is not so good.

Bethel, the head of navigation for ocean vessels, has a post office, mission, two stores and a wharf. The range of the tide is reported to be 3 feet. Two river steamers ply on the river 600 statute miles above Bethel. The deepest draft vessel taken to Bethel from sea is 14 feet, and 15 feet is regarded as the deepest draft that can be safely carried. It is reported that there may be a little less than 15 feet on some of the bars at low water.



